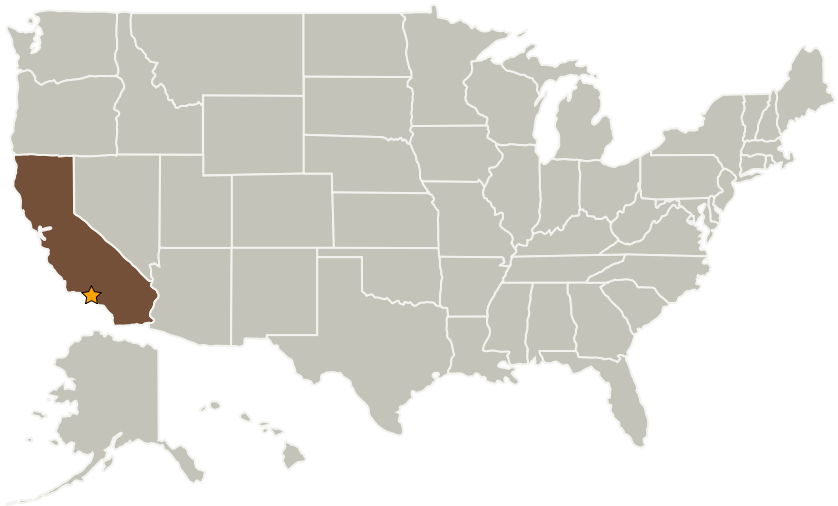
Lightweight Low Force Rotary Percussive Coring Tool for Planetary Applications, Phase II

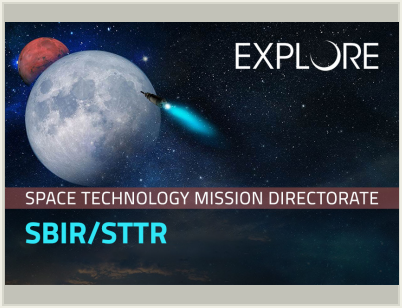
Completed Technology Project (2007 - 2009)

Project Introduction

Alliance Spacesystems, LLC produced a rotary percussive drill designed for space use under a NASA-funded Mars Instrument Development Program (MIDP) project -- the Low-force Sample Acquisition System (LSAS). The flight-like drill prototype that was the end result of the project successfully drilled and acquired 1 cm³ samples from a variety of rocks and soils including the hardest anticipated Martian rock (basalt) and frozen soil. This ability was demonstrated not only in ambient conditions but also in a thermal/vacuum chamber replicating Mars pressure and extreme temperatures. The rotary percussive approach is simple, robust, and highly efficient with regards to power and mass. During the SBIR 2006 Phase I effort, Alliance took this heritage device and expanded its potential to include coring against a variety of rock materials anticipated to be encountered on Mars. Through the use of a breadboard fixture, coring bit designs and coring parameters were evaluated to identify optimum combinations. At the completion of test a conceptual design was generated taking this coring experience into account and adding core retention, break and ejection features. A bit change mechanism, identified as a requirement for successful operation while maintaining design robustness and simplicity, was added as well. A Phase II effort is now proposed that will take this conceptual design into prototype form. Primary activities to be performed during Phase II will include: • Additional coring test runs to work out final details of detail bit design • Detail design and prototyping of core handling mechanisms • Prototype testing of core handling mechanisms • Design and manufacture of full prototype LSAS Corer system • Testing of prototype LSAS corer • Integration of LSAS corer onto robotic platform and functional demonstration

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Alliance Spacesystems, LLC	Supporting Organization	Industry	Pasadena, California

Primary U.S. Work Locations
California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.4 Sample Acquisition and Handling